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SANITATION OF FLOOD-STRICKEN TOWNS AND CITIES.

WITH SPECIAL REFERENCE TO CONDITIONS OBSERVED IN RIVER TOWNS AND CITIES OF KENTUCKY.

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Besides the considerable loss of human life and the tremendous destruction of property immediately caused by floods, such as occurred in the Ohio and Mississippi Valleys this spring, there are occasioned in many of the towns and cities of the flooded territory sanitary situations which give rise to well-founded apprehension.

The sanitary situations obtaining in the different flood-stricken towns and cities, though varying in degree, present a striking similarity in kind.

(1) Many people are compelled to abandon their homes, temporarily at least, and must be provided with places of refuge. Some may be domiciled in camps established especially for the purpose and others in private homes or public buildings located in parts of the town out of water. In any event, considerable numbers of people who ordinarily would not be closely associated are brought into propinquity, and the danger of the spread of whatever communicable disease may exist among them is increased.

(2) Food and clothing, ample in quantity and suitable in quality, are needed for those who are, for the time being, practically destitute. Under the generally upset conditions it is difficult to have the food supplies prepared and served with even the cleanliness usually exercised in the average home in a municipality. Therefore the likelihood of infection being conveyed by foods may be somewhat increased.

(3) The pumping station for the public water supply with its purification plant, if there be one, may be incapacitated. Many of the wells and cisterns may be overflowed and contaminated with the flood water, which, though capable by its tremendous volume to effect great dilution, suddenly has gathered up in its course much potentially dangerous contaminating matter. Deprived of the usual, and perhaps reasonably safe, drinking-water supplies some of the people are apt to drink almost any water accessible, includ-

ing the flood water flowing through the streets, even if it be somewhat objectionable in appearance, odor, or taste. Thus, the danger from water-borne infections, particularly that of typhoid fever, may be markedly increased. Not a large proportion of people who are passing or who have just passed through the obvious perils of a flood and are busied gathering together the few remains of property left them can reasonably be expected to heed warnings to boil water for drinking. In flood times the fuel and labor needed for boiling water are at a premium for other purposes. The placarding of a town, in such times, with warnings to boil water may relieve the authorities of some feeling of responsibility, but, in the experience of the writer, few of the people actually in a position to do so carry out such instructions consistently.

(4) Sewage may be backed up into basements and houses, as the water rapidly rising in the river interferes with the discharge from the sewers. Cesspools may be overflowed and privy contents washed around. Thus the dissemination of excreta-borne infections may be increased. In the parts of the town covered with water to a considerable depth, however, the sewage which backs into houses is tremendously diluted, and much of this diluted sewage, the overflow from cesspools and the washings from privies, is carried away as the flood water flows through or gradually recedes from the town. In fact, some of the towns immediately after the flood may be in better sanitary condition in respect to the dissemination of human excreta than they have ever been before.

(5) Insanitary privies and cesspools, always a menace to the health of a community, may become particularly dangerous in a flood-stricken city. The greatest danger is not from the insanitary privies which are washed away or under water, but from those which are in use during and subsequent to the time of high water. The whole or a considerable part of the town may be nonsewered. Many of the homes in sewerred areas may not be connected with the sewer. In the more elevated parts of the flood-stricken town many of the homes, having no sewer connections but insanitary privies or cesspools instead, may hospitably afford refuge to persons whose homes have been carried away or are in water. Under these conditions, privies and cesspools, insanitary under ordinary usage as a rule, are severely overtaxed and become grossly insanitary.

In the nonsewered parts of the town a large proportion of the outhouses may have been overturned or carried away by the flood. As the water recedes the people return to these sections to rehabilitate and reoccupy their homes, and the scarcity of serviceable toilets is liable to lead to a certain amount of promiscuous polluting of the soil and to a severe overtaxing of the privies which can be used.

The writer found in some of the towns which he visited encampments with inadequate and very faulty toilet arrangements, the privies being loosely constructed and unscreened houses open in back or leaky at back and sides and without receptacles under the seats, the excreta piling up on the surface of the ground or overflowing the trenches under the seats and heavily polluting the surface of the ground for considerable areas around the houses, privies, also of insanitary type, at private homes in the neighborhood being used and overtaxed by persons from the camps who wished to avoid the filthy camp latrines, and the encampments and their environs thus presenting conditions, in respect to the dissemination of human excreta, comparable to those of some of the national encampments during the Spanish-American War.

That some of the flood-stricken towns in which such conditions obtained did not have serious outbreaks of typhoid fever and other diseases caused by excreta-borne infections was probably because the season was early spring instead of late summer, and the periods of encampment were usually short.

(6) Débris and mud in great quantity, containing perhaps a certain number of carcasses of animals and a certain quantity of sewage or contents of cesspools and privies, may be left in the streets, alleys, and yards of the town as the water recedes. While the débris and mud, with an occasional dead animal, are objectionable and the putrefaction of dead animals may give rise to appearances and odors actually nauseating, their importance from a standpoint of infectious, disease causation is usually in the popular mind very much overrated, while conditions such as those pertaining to the water supply and to disposal of human excreta, constituting a very much greater menace to the health of the community, are liable to receive from the people generally much less, and certainly too little, attention.

(7) The houses in the flooded sections in which people have remained during the period of high water or to which people have returned as the water receded may be damp throughout, and the parts which were under water may be grossly soiled with mud left by the flood. Many of the basements and cellars may remain full of water for days after the water has receded from the streets. The heating apparatus for the house may be located in the basement and and therefore be, for the time being, unserviceable. Some houses may not have on the upper floors arrangements for heating, as with grates or stoves. For those which have grates and stoves adequate fuel may be lacking or obtainable only with great difficulty. When heating facilities are at such a premium it is to be expected that many of the people will conserve heat by keeping windows and doors of rooms for living and sleeping closed. Frequent instances of families sleeping—perhaps in damp clothing—in rooms presenting the condi-

tions of "indoor tropics" may be found. Under the conditions of dampness and poor ventilation an increased rate of diseases of the respiratory tract may obtain.

8. The sick, including cases of communicable disease, under the generally upset conditions of affairs may not receive the attention and care that they would in ordinary times, and, in consequence, be apt not only to suffer more, but also to spread whatever infection is among them more extensively. A case of typhoid fever or of scarlet fever, for instance, which would have been kept strictly confined to bed may become under force of the circumstances ambulatory.

Measures Generally Applicable for the Prevention of Outbreaks of Infectious Disease in Flood-Stricken Municipalities.

The work of sanitation in the affected town or city should be placed under the direction of a competent organization clothed with ample authority. A special committee may be appointed for the purpose, but it is decidedly advantageous, when practicable, to have this work directed by a regularly appointed and permanent local health organization, which may continue to have needed sanitary measures carried out after all excitement about conditions immediately resulting from and following the flood has passed. It may be particularly advantageous in some instances to have a skilled sanitarian from the State health department or from the National health service come to advise and cooperate with the local authorities. Apart from any additional technical knowledge of sanitation which the sanitarian from outside the community may bring, the mere fact of his coming may serve to increase intelligent popular interest and confidence in the measures advised.

Among the sanitary measures usually indicated in the flood-stricken towns are the following:

(1) *The establishment and maintenance of good sanitary conditions in encampments for refugees.*—In selecting the camp sites regard should be given to character of soil, topography, accessibility, availability of good water supply and sewerage, and to general sanitary conditions in neighborhood. A loose gravelly or sandy soil is preferable to a clayey one. The gentle slope of a hill affording good natural drainage, and particularly if somewhat sheltered by surrounding hills, has advantages. Nearness to supply stations will save labor and expense of transportation. Safe water supplies should be furnished the encampments. If the city supply is good the piping of it to the encampments is usually advisable. Open wells and springs in or near civilian encampments are particularly liable to contamination. If the water which must be used is of questionable safety, it should be treated under supervision of the camp authorities by boiling or by treatment with hypochlorite of lime. The Waterhouse-

Forbes sterilizer, which has been used extensively in the United States Army, is well adapted for the boiling of water in these camps. If a water-carriage sewerage system is available and sanitary water closets can be installed, one of the greatest difficulties of camp sanitation will be met. Therefore camp sites, so far as practicable, should be selected with a view to having connections with the city sewerage system. Grossly insanitary parts of the city, especially if unsewered, should not be selected for camp sites.

The tents used should afford thorough protection and good ventilation. Such tents for use by flood sufferers appear to be obtainable in ample numbers from State and national military organizations. A trench should be dug around each tent to prevent flooding by rains and the tents should be floored, if practicable.

The camp should be provided with adequate toilet facilities, so that there will be no need for occupants of the camp to use toilets outside the encampment. If a water-carriage sewerage system is not available for the encampment, sanitary privies—that is, privies which are provided with water-tight receptacles for the excreta, and which are so constructed that their contents will not be accessible to flies—should be provided. A good disinfectant solution, such as carbolic acid, 1 part to 19 parts of water, or chloride of lime, 1 pound to 8 gallons of water, should be used liberally on the excreta, and when the receptacles become about two-thirds full, their contents should be removed in a cleanly way, carried to a proper place without the camp, and buried or burned. In the maintenance of sanitary conditions in a camp, no other measure is so important as is the proper collection and disposal of human excreta. For the proper care of the privies an adequate scavenger service should be provided, and its work carefully supervised. The importance of preventing the dissemination of human excreta in a camp much more than justifies the labor and expense of construction and maintenance of sanitary devices, even under the usually trying circumstances attendant upon the establishment of a camp for flood sufferers.

In camps to be occupied for only a few days in localities presenting certain favorable conditions in respect to soil formation, topography, and ground water, there may be used with a reasonable degree of safety deep narrow trenches in the ground, instead of water-tight receptacles for the excreta.

If this compromise system is to be adopted careful regard should be given to the possibility of causing pollution of water supplies, such as wells and springs, in the neighborhood. The contents of the trenches should be thoroughly protected against fly invasion by having screened houses or seats over the trenches. The trenches should be 4 to 8 feet in depth and not more than a foot and a half in width. Disinfectant solution should be used liberally in the

trenches. When the trenches become filled to within 12 to 18 inches of the surface of the ground, the houses over them should be moved to new trenches and the old trenches after liberal treatment with a disinfectant, such as quicklime, be filled and mounded over with earth to a height of several feet above the surface. Another system, which might possibly be feasible under refugee-camp conditions, is to line the trenches daily with some readily inflammable material, such as hay, straw, or shavings, and by the liberal use of kerosene oil to burn out daily the contents of the trenches.

Too much emphasis can not be placed on making the deposits of excreta in camps inaccessible to flies. In every refugee camp which the writer visited this spring there were already, even so early in the season, on pleasant days, some flies busily engaged wherever opportunity presented in traveling from human excreta to human foods. Camps should be kept thoroughly policed, under the immediate direction of some person continuously at the camp and responsible to the authorities.

Garbage and other refuse should be collected in proper fly-proof and water-tight receptacles, removed daily, and properly disposed of by burning or burial. On exposed excreta or garbage Paris green solution may be used to prevent fly breeding or kerosene oil may be used as an insect repellant.

All persons given refuge in the camp should be inspected upon admission and daily while there, so that cases of communicable disease may be detected early, and isolation and other necessary measures be exercised to prevent spread of the infection.

(2) *The securing of a safe and an adequate water supply.*—If there be a public supply, steps should be taken at once to insure its safety and its usual distribution. With a good and freely distributed public water supply in a flooded town a large element of danger from outbreaks of infectious disease is eliminated. If the public supply be readily accessible and regarded as safe, people are nothing like so apt to use water from shallow wells, underground cisterns, and other sources which are particularly liable in flood times to be dangerously contaminated.

Treatment of water with hypochlorite of lime is a great sheet anchor of safety in such emergencies. For most of the towns visited by the writer the application of this treatment to the public water supply was recommended by him and adopted by the waterworks officials. The cost of the treatment is very reasonable, for the majority of water supplies only about 8 pounds of the "chloride of lime" being required for each million gallons of water. The apparatus for applying the treatment is simple and may be installed in a few hours. The solution may be applied as the water enters or leaves a reservoir or as it flows through a conduit or main.

The solution should be applied as the water flows through some place at a known rate, so that the proper amount of the solution will become mixed with a known volume of water. The water supply of a city of 5,000 to 20,000 population may be treated with a very simple emergency apparatus, consisting of three ordinary 50-gallon barrels and a little piping, one of the barrels to be used as a mixing tank for making the solution and the other two barrels to be used as distributing tanks. The hypochlorite treatment probably should not be relied upon to disinfect waters which are highly turbid. A water supply having a high turbidity should be subjected to some clarification process, such as coagulation, sedimentation, or mechanical filtration or some combination of these, before having the hypochlorite treatment applied.

Water in cisterns, if clear or nearly clear, may be treated effectively with hypochlorite of lime. To treat 5,000 gallons of water in a tank or cistern, proceed as follows: Put 1 ounce of good chloride of lime (containing at least 30 per cent of available chlorine) in a vessel containing about 2 gallons of water; shake or stir rapidly for about a minute; let vessel set for about five minutes, so that most of the insoluble part of the lime will settle to the bottom; pour the solution into the cistern and by some mechanical means agitate the water so that the solution will be quickly diffused throughout the volume of water. Water on a still smaller scale—by the bucketful in the private home, for instance—may be treated by the hypochlorite process; add 1 teaspoonful of good "chloride of lime" to 1 pint of water and keep the solution in a tightly stoppered bottle; add 1 teaspoonful of this solution to 2 gallons of water to be used for drinking and stir in quickly; let water so treated stand for 15 to 30 minutes before being used. The stronger solution used in the treatment of water on this small scale is to afford a liberal margin of safety.

Bottles of the hypochlorite solution may be made up and properly labeled at central stations, and distributed to private homes not having ready access to entirely safe water supplies. The application of this method of treatment of water in the private home, while perhaps not furnishing as absolute a safeguard as boiling the water would, has proved to be feasible in some flood-stricken towns. Many people who can not or will not go through the troublesome task of boiling all water for drinking will use the hypochlorite method.

People should be warned against using untreated water from polluted wells and cisterns. Where safer water supplies are available water from shallow (dug) wells and contaminated cisterns should not be used. Such cisterns should be pumped out, disinfected with hypochlorite of lime solution (1 pound to 8 gallons of water) and refilled from subsequent rains. Shallow wells, polluted or obviously exposed to dangerous pollution, should, wherever feasible, be abolished permanently by official action.

(3) *The adoption of safeguards to prevent dangerous dissemination of human excreta in the community.*—Any disorder in the sewerage system occasioned by the high water should be corrected as promptly as possible. As the high water begins to recede the sewerage system as a rule will return to its normal condition.

The main trouble with sewerage systems of flood-stricken towns usually is their lack of extent. A municipality having a complete and properly installed water-carriage sewerage system would not be apt, after being flooded, to present a sanitary situation of much gravity. Conditions associated with insanitary privies and cesspools in nonsewered sections and at homes in sewer sections not connected with the sewers, constitute as a rule the gravest menace to health in a flood-stricken town. In nonsewered sections, temporarily congested by the influx of refugees, additional privies of a sanitary type should be installed. An adequate scavenger service should be provided to dispose of night soil in a sanitary way and an adequate inspection service should be provided to see that the privies are maintained in sanitary condition. As the high water recedes and the people begin to return to the flooded sections to repair their damaged homes, the installation of a certain number of public convenience stations in those sections may be advisable. As the work of rehabilitation begins, proper toilet facilities in the homes should be among the first things to receive attention. Privies carried away by the flood should be replaced with sanitary ones and privies overturned or otherwise damaged should be reconstructed with, usually needed, improvements.

(4) *The treatment of all insanitary privies and cesspools with a liberal quantity of disinfectant solution.*—Since the prompt reconstruction along sanitary lines of all privies will not be feasible as a rule, a considerable safeguard may be secured by a kind of "shotgun" disinfection of all insanitary privies and cesspools in the town. This can be and should be done at once and under official supervision. Squads of laborers with wagons carrying disinfectants and mixing tubs should be sent out to cover systematically the different sections of the town in which there are privies or cesspools. Each privy should be treated with 8 or 10 gallons of disinfectant solution, the solution being applied liberally to the woodwork and the pit under the seat. Among the good cheap disinfectants for such use are (a) chloride of lime solution, made by adding 1 pound of good chloride of lime to 8 gallons of water, and (b) quicklime solution, made by adding 10 pounds of good unslaked lime to 10 gallons of water. This systematic sluicing of privies should be repeated once every week or 10 days until the faulty privy conditions have been permanently corrected or at least reverted to their normal. Privy pits and cesspools from over which the houses have been carried away should be treated with the disinfectant solu-

tion and filled with earth. Areas around overflowed privies and cess-pools, as in alleys and yards, which have been heavily polluted should be soaked with the disinfectant solution.

(5) *The enactment and rigid enforcement of ordinances requiring a prompt report of cases of communicable diseases.*—The prompt discovery of and the enforcement of proper precautionary measures about cases of infectious disease, important at all times, is especially important in the disturbed conditions of flood times. Circular letters should be sent to the physicians calling their attention to the existing or the specially enacted ordinances respecting the report of cases of communicable diseases, and their active cooperation requested. Cases which may be even slightly suspected to be infectious should be treated as infectious until the contrary is known. Hospitalization of infectious cases should be encouraged and demanded so far as may be practicable. Precautionary measures about the bedsides of infectious cases treated in homes should be carried out under official supervision. Visiting nurses should be provided to assist in this work.

(6) *The conducting of a systematic search for the sick.*—In the flooded sections and in the sections congested with refugees, frequent visits—practically a house-to-house canvass—should be made to discover and to render needed assistance to the sick. By this search there may be found cases of infectious disease endangering the community, and also cases of ordinary sickness seriously needing assistance. Visiting nurses are needed for this work, and if they can not be furnished by the town they may be secured by making application to the National Red Cross Association.

(7) *The removal and proper disposal of débris, mud, and dead animals from streets, alleys, yards, and houses.*—A sufficient number of teams and laborers should be provided. This work should be begun as the water begins to recede, because much of the mud may be shoveled or scraped into the receding water and be carried away by the current. Some of the débris may be used for firewood or other purpose. What is useless should be taken to a suitable place and destroyed by burning. Dead animals should be carried to suitable places and disposed of by cremation or by burial. Mud in streets, alleys, and yards should be either washed away with a flushing hose or raked into heaps and hauled away. The sprinkling of air-slaked lime in streets and yards, a measure commonly practiced in flooded towns, does little, if any, good, and may give a false sense of security, Sunshine and air will quickly accomplish whatever surface disinfection may be necessary of mechanically clean streets and yards. If disinfection of the ground surface is attempted, some actual disinfectant (not air-slaked lime) in solution should be employed.

(8) *The securing of concerted action for the cleansing, drying, and ventilation of flooded houses.*—The authorities should instruct the

people generally, through the columns of the local press, through public addresses, or otherwise, about the importance of and the methods for having flooded houses in good sanitary condition before reoccupying them. If a sufficient force of sanitary inspectors has been provided to make it feasible, inspection of flooded houses should be made and permits from the health department to reoccupy required. Basements and cellars should be pumped out. Mud should be scraped and washed out, and after the portions of the houses which were flooded have been rendered mechanically clean the walls and floors should be washed with a disinfectant solution, chloride of lime, 1 pound to 8 gallons of water being well adapted for the purpose.

After being cleaned the houses should be sunned as much as possible, and aired by keeping windows and doors open, and, when practicable, open fires going. Houses should not be reoccupied until reasonably dry and sweet. The people are much better off in a well-managed camp than they would be in damp, poorly heated, and poorly ventilated houses.

(9) *The use of agents for the production of specific immunization against certain infections.*—If smallpox prevail in the community, the people generally who are not already protected by vaccination—including especially those in the encampments and in the congested sections—should be vaccinated as promptly as possible. The only reasonable objection which can be raised against extensive vaccination at such a time is that the soreness of arms may interfere somewhat with the performance of manual labor, for which the circumstances create an unusually great demand. This objection, however, is more than offset by the special danger of extensive spread of the infection as a result of the unusually close association between large numbers of persons. The working efficiency of the community will not be lessened as much by having a certain number of persons incapacitated with sore arms as it will be to have one-tenth or one-twentieth of a like number incapacitated with smallpox.

Antityphoid inoculation, though not possessing all the advantages as a protective agent against typhoid fever that vaccination possesses as a protective agent against smallpox, may be advised. Three injections 10 days apart, and each attended by a certain amount of discomfort, are required to produce the theoretical maximum of protection. The duration of the period of protection is not known. It is supposed to vary in individual cases from six months to several years. The antityphoid inoculations are not supposed to afford protection to persons who are already incubating the infection of typhoid fever. The greatest danger from typhoid outbreaks in flood-stricken communities obtains, as a rule, in the time of high water and in the week or 10 days immediately subsequent thereto. Therefore, the protection

by antityphoid inoculation of any considerable proportion of the population may not be practicable until some time after the period of greatest danger has passed.

It would not seem advisable to undertake in a civilian community compulsory antityphoid inoculation. The method of administering the agent, somewhat cumbersome at present it must be admitted, and the extent of actual danger to be obviated by its use, would need careful consideration before a course of compulsory inoculation could be wisely decided upon. Although it now seems definitely established that antityphoid inoculations give to exposed persons a marked degree of protection against typhoid infection, only a small proportion of persons in the average community, in the present stage of exploitation of this agent, will voluntarily obtain antityphoid inoculation. This appears to be particularly true for flood-stricken communities where temporary incapacitation for work—such as may result from either vaccination against smallpox or inoculation against typhoid—would be especially inconvenient. Other measures—such as the correction of faulty water supplies and the sanitation of faulty privies—for the prevention of typhoid outbreaks will be, as a rule, immediately practicable in flood-stricken towns, and will prevent the spread not only of specific typhoid infection, but also of the other excreta-borne infections. Measures which can be carried out by action of the municipal authorities are much more feasible in flood times than are those which depend for their enforcement upon the voluntary and deliberate action of the individual citizens.

From his recent observations the writer is of the opinion that antityphoid inoculation should be made available and advised in flood-stricken towns and cities, but, like propaganda for the boiling of drinking water, should not be depended upon to the neglect of other and immediately practicable measures.

(10) *The securing of permanent sanitary improvements.*—The inspection of a flood-stricken town will usually bring to light a number of insanitary conditions which existed before the coming of the flood and which need permanent correction. Thus, in usual times, the water supply may have been exposed to gross and dangerous pollution, and not subjected before distribution to efficient purification processes; the sewerage system may have been inadequate, and grossly insanitary privies and cesspools may have been numerous in thickly settled sections; the collection and disposal of stable manure, garbage, and other refuse may have been inadequate and faulty; sanitary inspection, including food inspection, may have been insufficient and the whole local health department undermanned and not provided with funds adequate for efficient service. No opportunity should be lost to point out to the people generally the conditions which, though aggravated perhaps by the high water, should not have been tolerated

even had no flood occurred. The work of sanitation precipitated by the apprehension aroused by the flood conditions may educate the municipal authorities and the people generally to a realization of the feasibility and the advantages of sanitation and thus turn the disaster of flood to permanent advantage for the community.

Observations and Operations for the Sanitation of Flood-Stricken Towns and Cities in Kentucky.

On April 2, 1913, the Surgeon General of the Public Health Service received from the local authorities of Catlettsburg, Ky., an urgent telegraphic request to send an officer to assist in sanitation in that vicinity. The writer was detailed for the duty and arrived at Catlettsburg on the morning of April 4. Upon arrival there the writer, in accordance with official instructions given him, conferred with the local authorities about the sanitary situation in Catlettsburg and communicated with the secretary of the Kentucky State Board of Health his desire to cooperate with the State and local authorities in the enforcement of such measures as might be necessary to prevent the spread of infectious diseases in interstate traffic. He was placed at once practically in charge of the work of sanitation in Catlettsburg and later on was detailed on the request of the State health authorities to visit, for the purpose of making sanitary inspections and of advising with the local authorities about sanitation, other flood-stricken cities and towns in Kentucky, including Maysville, Paducah, Wickliffe, and Columbus. Duty in these several places was continued until April 19.

CATLETTSBURG.

Catlettsburg has a population of about 4,000. The town is located on the left bank of the Big Sandy and the Ohio Rivers above and below the point of their confluence. It is built up mainly on the low river land, which gradually increases in elevation, however, as it extends from the river to a range of high hills, which skirts the west side of the town. While extending along the bank of the river a distance of about a mile and a half, the town averages only about two city blocks in width. At the time of the high water the banks of both the Ohio and the Big Sandy were greatly overflowed, and Catlettsburg was severely flooded. Over 90 per cent of the houses in the town were in water. The rivers began to overflow their banks on March 27. When the flood reached its crest, on March 30, the water was about 15 feet in depth along the water front of the town and about 8 feet in depth in one of the principal streets two blocks away from the river. Many of the houses were severely damaged, some overturned, and some carried away by the flood. Several hundred

persons were rendered homeless. The water began to recede on March 31 and was out of the streets by the morning of April 4. The flood left a heavy deposit of mud in the streets and yards, in many places 5 to 10 inches in depth. Tremendous amounts of débris, consisting of driftwood, trees, lumber, wreckage of houses, etc., were scattered over the town. The municipal authorities and the people generally set to work in good earnest to improve conditions.

When the writer arrived on the morning of April 4, a good force of men with teams and wagons was engaged under the direction of a committee appointed from the city council in cleaning streets, alleys, and yards; a special relief committee was busily engaged, as it had been for several days, in distributing to the needy, foods and clothing which had been supplied in abundance and with highly praiseworthy promptness by the United States War and Navy Departments; two camps in different parts of the town had been established for homeless persons, and the town was thoroughly placarded with warnings to the people to boil drinking water.

Among the first matters to receive the personal attention of the writer were the city water supply, the camps, and the numerous insanitary privies and cesspools in the town. The waterworks are owned and operated by a stock company. The intake for the water supply is in the Big Sandy River at a point upstream from all the outlets of the town sewers, but downstream and only a few hundred yards from the mouth of a surface stream (known as Hampton Branch) which directly or through its tributary branches is grossly contaminated with the contents or drainage from the contents of two or three hundred privies located at homes in the south end of the town or in the immediate vicinity thereof.

This stream, ordinarily carrying a small volume of water, is practically an open sewer. Upon inquiry, the writer was informed by a number of citizens that the public water supply in ordinary times was usually noticeably turbid. The pumping station, it was said, had been incapacitated for only one day by the flood. As the high water receded from the town an unusually heavy draw on the public water supply was occasioned by the great amount of washing of streets and houses which went on. The public water supply as it was being distributed on April 4 was highly turbid. On the afternoon of that date, the writer, accompanied by the superintendent of the plant, made an inspection of the waterworks. At the pumping station, located near the river bank, the water was being treated with a coagulant (lime and sulphate of iron) and then pumped a distance of about a half mile to the sedimentation reservoirs on top of a hill overlooking the town. The reservoirs are of the open type and consist of excavations in the natural soil formation encircling the top of the hill. They are of sufficient extent and capacity to effect, when

properly operated, a reasonably good sedimentation of the water. At the time of this inspection, however, there was practically no storage of water in the reservoirs, the water being run through them as an open stream and carrying with it a large proportion of the mud (and, of course, also the bacteria) which it contained as it left the river. Considering the pollution of the river at the location of the intake, the water supply as it was then being delivered could not have been reasonably regarded as a safe one. The writer suggested (1) an increased clarification of the water by using an additional amount of the coagulant, if necessary, and by securing a good storage of water in the reservoirs, the pumping thereto to be increased and the distribution therefrom, if necessary, to be decreased for a time—so that the water would have time to undergo proper sedimentation; and (2) a continuous treatment of the water, after sedimentation, with hypochlorite of lime.

These suggestions were acted on promptly by the waterworks officials, and within 24 hours the water distributed to the town was practically clear—much clearer, it was said by a number of the citizens, than it usually was in ordinary times—and as it flowed from the main sedimentation reservoir the water was receiving what appeared to be a proper treatment with hypochlorite of lime solution. Under these improvements the public water supply was one which on general principles could be regarded as reasonably safe, and thus it appeared that one big step toward safeguarding the community had been accomplished. The people were warned against using water from possibly contaminated cisterns or shallow wells unless such water prior to use was boiled or treated with hypochlorite solution. Bottles of the hypochlorite solution in large number were prepared and extensively distributed. Many of the people used the hypochlorite solution for the treatment of drinking water in private homes and thus proved the feasibility of this measure. The permanent closing of a number of shallow dug wells exposed obviously to dangerous pollution was recommended to the city council.

One of the encampments was well located and needed only a few improvements to place it in reasonably good sanitary condition. The other encampment, containing about 15 families, was located in proximity to a number of private homes at which the sanitary conditions were bad. At some of these homes there were shallow open wells down hill from and within 20 to 30 feet of grossly insanitary privies which were being severely overtaxed from the additional use of them by the persons in camp.

The sewerage system reaches about 60 per cent of the town's area. In the sewered sections not more than about 50 per cent of the houses have sewer connections. At houses in the nonsewered sections and at those in the sewered sections but not having sewer connections

privies generally were in use. At the time of the flood all or certainly almost all of the hundreds of privies in use in the town were of insanitary type. Some were of the open-back surface variety, some overhung small-surface streams or open ravines, and some had deep pits in the ground under the seats. None seen or heard of was fly-proof. The superstructures and some of the contents of many of the privies were carried away by the flood. Upon the recession of the water many accumulations of night soil were left exposed on the surface of the ground or in the pits over which the houses had been. Many insanitary privies in sections which were habitable immediately after the flood were being overtaxed by the extra number of persons using them. As the high water began to recede the public water-carriage sewerage system had resumed its normal operation, and had the whole town been sewered and properly connected with the sewers the sanitary situation in Catlettsburg, after the flood, would have been simple and readily correctible. The conditions associated with the many insanitary privies constituted a serious problem and one difficult of quick and satisfactory solution.

Authority to expend money from the epidemic-disease fund of the United States Public Health Service for the employment of laborers and the purchase of disinfectants for use in Catlettsburg and vicinity with a view to preventing interstate spread of disease was obtained from the Treasury Department in Washington. Under that authority an ample quantity of disinfectants was obtained and a force of laborers was employed and kept at work for a period of 15 days under the direction of the writer. These laborers were divided into three squads and each squad with a wagon and team to carry disinfectants and mixing tubs was assigned to duty in one-third of the town to search out systematically and treat liberally with disinfectant solution every privy and cesspool. The first round of the privies was begun on April 7 and completed on or about April 10. A second round was made about 10 days later. The disinfectant solution used in the privies was one either of chloride of lime or of quicklime, and about 10 gallons of the solution were used in each privy. Besides carrying out this "shotgun" disinfection of privies and cesspools, the Public Health Service laborers assisted in the disinfection of water cisterns and cellars, in the fumigation of some public buildings which had been occupied by refugees, in the preparation and distribution of bottles of hypochlorite solution for use in the treatment of water for drinking at private homes, in the rehabilitation and sanitation of privies, and in other work of a strictly sanitary nature.

On the recommendation of the writer a town health officer was appointed by the city council on April 5. Three Red Cross nurses requisitioned from the National Red Cross Association headquarters in Cincinnati, arrived in Catlettsburg on April 6 and were set to work

seeking out and helping care for the sick, especially for cases suspected to be infectious. These nurses rendered excellent service not only in finding and helping care for the sick, but also in the course of their frequent rounds—practically house-to-house canvasses—of the town in obtaining for the relief committee specific information about the need of foods and clothing among the flood sufferers.

All of the practicing physicians of the town were communicated with directly and their cooperation was requested in respect to the prompt reporting and the carrying out of prophylactic measures about recognized and suspected cases of infectious disease. At a citizens' meeting on April 6 the people were advised about sanitary measures to carry out in their homes. The local newspaper, as soon as its printing machinery had been repaired from damage by the flood, rendered excellent service by giving conspicuous publicity to sanitary matters. A general spirit of cooperation appeared to prevail in the community and the work of sanitation progressed well.

By April 11 Catlettsburg was probably in better condition from a strictly sanitary standpoint than it was before the flood. No evidence of any outbreak of any infectious disease had appeared and the work of sanitation was being continued at a good rate. On April 11, before leaving Catlettsburg for a trip in the western end of the State, the writer, at a meeting with the mayor and city council, submitted the following recommendations:

1. Require a prompt report to the health officer of all suspected and recognized cases of typhoid fever and of other infectious diseases.

2. Have rigid precautions exercised, under official supervision, about the bedsides of all cases which could reasonably be suspected to be infectious in nature, and, so far as might be practicable, have all persons sick with typhoid fever or other dangerous communicable disease sent for care and treatment to the hospital in Ashland.

3. Appoint a well-qualified man as assistant health officer, with a salary adequate to justify requiring him to devote all of his working time to health work.

4. Have continued, under necessary official supervision, the clarification and the hypochlorite treatment of the public water supply.

5. Have all shallow dug wells on premises where other and safer sources of water supply might be available permanently closed.

6. Assist with public labor so far as might be necessary the rehabilitation and sanitation of privies, and require all occupied houses to be provided with either properly connected water-closets or reasonably sanitary privies.

7. Have the cleaning of streets, alleys, yards, and houses continued at as rapidly an increasing rate as might be practicable.

8. Have the public water supply protected against pollution from the foul water discharged through Hampton Branch, either by having

the intake of the water system carried up the river to some point above the mouth of Hampton Branch or by having the section drained by this creek sewerred and the sewage discharged at points downstream from the present location of the intake for the water supply.

9. Enact and rigidly enforce an ordinance requiring all habitations within the publicly sewerred and watered area to be properly connected with the sewerage system.

10. Have the sewerage system extended as rapidly as practicable to cover the whole town.

11. Require all privies in the town to be made fly proof, to be provided either with water-tight receptacles above the surface of the ground or with properly walled excavations below the surface of the ground to receive the excreta, and, under official supervision, to be maintained at all times in good sanitary condition.

12. Have condemned as unfit for human habitation all properties which could not be made reasonably sanitary.

Of these recommendations the first seven were urged as feasible for immediate adoption, and the last five were urged as permanent policies to be adopted and carried out as rapidly as circumstances might permit.

The writer returned to Catlettsburg on the afternoon of April 17. He found that the general work of sanitation during his absence had been progressing at a gratifying rate, but to his surprise and disappointment he learned that the public water supply was again highly turbid and had been so since the day before. On inspection by the writer and the local health officer it was found that the reservoirs had been allowed for some reason to become nearly empty and the water was being run through them without time being given it for proper sedimentation to take place. The operation of the hypochlorite plant had been discontinued, and the public water supply, so far as its mud content and its potential dangers from pollution at the intake were concerned, was in just about the same condition as it was when inspected on April 4. Furthermore, at the time of the inspection on the afternoon of April 17 deposits of human excrement (at least eight in number) were found on or near the banks of two of the storage reservoirs on the hill. Several of these deposits were on the side of the bank sloping toward the reservoirs and at one point less than 6 feet from the water's edge. These necessarily would have been washed into the water supply had heavy showers of rain occurred. It was obviously possible for any of the deposits near the bank or on the slope of the bank distal to the reservoirs to be carried by insects or worms or on the feet of persons or animals to the slope of the bank over the water's edge or actually into the water. The presence of these deposits in the immediate vicinity of the hypochlorite plant denoted a gross care-

lessness on the part of the men who had been operating the plant or on the part of those who were supposed to exercise vigilance to protect the water supply against readily avoidable nuisance.

At the time, however, the presence of these deposits did not suggest anything like as great potentialities of danger as did the contamination of the water supply with the discharge from Hampton Creek, since its mud content indicated that the water as then distributed was not being effectively treated by purification methods after it entered the water system at the intake. Before a meeting of the city council on the night of April 17, the writer reported on the condition of the water supply, stating that, in his opinion, the public water supply as then being distributed was unsafe and recommended (1) the exercise of official supervision over the operations of the public water system and (2) the enactment of an ordinance requiring that the public water supply as distributed to the town should not at any time contain more than one (1) colon bacillus to the 50 cubic centimeters of water—fermentation with gas production in standard lactose bile or lactose bouillon to be accepted as evidence of the presence of the colon bacillus and the examinations of the water samples to be conducted according to the following method:

Plant 10 c. c. of the water in each of 5 fermentation tubes. Incubate the planted tubes at about 37° C. for 48 hours. Accept the production of gas in none or only 1 of the 5 fermentation tubes to mean not more than 1 colon bacillus to the 50 c. c. of water. Accept the production of gas in 2 or more of the 5 fermentation tubes to mean more than 1 colon bacillus to the 50 c. c. of water.

Since that meeting the city council of Catlettsburg has appointed an assistant health officer; has named a full city health board, consisting of five representative citizens, with the health officer as secretary of the board; has passed a drastic ordinance requiring the public water supply at all times to be within a certain bacterial standard of purity; has ordered the local waterworks company to remove the intake of their receiving pipes up the Big Sandy River to a point above the mouth of Hampton Branch, and to build a close-meshed fence at least 5 feet high around the reservoir; has passed an ordinance forbidding trespass on the property of the waterworks company in the vicinity of the reservoirs; and has appointed a committee to investigate and report on the cost and feasibility of extending the local sewerage system, of installing a garbage incinerator, and of providing for improved methods of collecting and disposing of night soil, garbage, and other city refuse.

Since April 17 there have been no outbreaks or unusual prevalence of any infectious disease reported in the town,¹ the general work of

¹ From Apr. 20 to June 7 there have been reported in Catlettsburg and its immediate vicinity only five cases of typhoid fever, and all of these cases developed among persons residing in the Hampton Branch section.

cleaning up has gone on at a good rate, and from present indications Catlettsburg will soon occupy an advanced position in hygienic progress.

MAYSVILLE.

Maysville, with a population of about 10,000, including that of suburban villages, was flooded at the same time as was Catlettsburg. About 65 per cent of the houses in the city were in water. The conditions occasioned in Maysville by the flood were, though proportionately of less extent, strikingly similar in character to those observed in Catlettsburg.

The public water supply for Maysville is obtained from the Ohio River. The intake is downstream and only a few hundred yards from the outlet of one of the main city sewers. The water supply is treated by the use of a coagulant (lime and iron) and mechanically filtered. The waterworks were incapacitated for three or four days during the period of high water, and on those days water from various sources, including springs, wells, and cisterns in the hills, was conveyed by means of boats to homes in the flooded sections. About 60 per cent of the houses in the city are connected with the water-carriage sewerage system, and the others are provided with privies or cesspools, almost all of which are of insanitary type. The area of the city which was flooded was in large part comprised by the non-sewered sections.

Typhoid fever is quite prevalent in Maysville, about 100 cases occurring in the city each year, and several cases were under treatment when the flood occurred. No cases of smallpox had been known to exist in the city for some time prior to the flood, and none was found in the period of the flood. There had been since the beginning of the year about 30 cases of cerebrospinal fever, and several cases were still under treatment at the time of the flood.

Several hundred flood sufferers were domiciled temporarily in large warehouses which were connected with the sewers and were readily kept in reasonably good sanitary condition. The writer arrived at Maysville on the night of April 8 and on the following morning conferred with the members of the city board of health and the county health officer and made with them a sanitary survey of the city and its environs. The work of sanitation under the direction of the city board of health evidently had been carried on energetically. Most of the débris and mud left by the flood had been cleaned away. Quicklime had been sprinkled liberally in yards and alleys. Basements and cellars were being pumped out and disinfected. A liberal supply of antityphoid vaccine had been obtained and the administration of it offered free of charge. The merits of this agent were given for several days conspicuous and

extensive publicity through the local press and in other ways, and the afternoon of April 9 was designated as the time on which the extensive plan for the inoculation of the people was to be put into operation. On that afternoon a number of stations for administering the prophylactic were opened at school buildings and other public places in different parts of the city, so as to be convenient to the whole population. To assist the health department officials in the operation of these stations the services of a number of the practicing physicians in the city had been obtained. At the appointed time on the afternoon of April 9 the physicians with their assistants and equipments were at the different stations ready to do business, but no one appeared at any of the stations to receive the inoculation. Thereupon the maintenance of the public stations for antityphoid inoculations was discontinued, and in the several days following not more than 5 or 6 persons applied for and received the inoculations.

After completing his sanitary survey of the city on April 9 the writer, at the request of the city health department, made before a meeting of the city council and board of health of Maysville a formal report embodying the following recommendations:

1. Treatment of the city water supply with hypochlorite of lime (containing 30 per cent of available chlorine) 10 pounds of this chemical to be used in each million gallons of water.

2. The distribution of hypochlorite solution for use in the treatment of drinking water in homes.

3. Treatment of every privy and cesspool in the city with a solution of quicklime—10 pounds of the lime in 10 gallons of water to be used in each privy or cesspool.

4. Obtainment of four Red Cross nurses to help find and care for the sick, especially cases of infectious disease.

5. The enactment and rigid enforcement of an ordinance requiring every house in the sewered area to be properly connected with the sewerage system within the earliest time reasonable—60 days being suggested.

6. The extension of the sewerage system as rapidly as practicable to cover the whole city.

The council at once by resolution adopted these recommendations, and the mayor appointed a committee, composed of one councilman from each of the six wards of the city, to cooperate with the city board of health to see that the recommendations were carried out. Said committee was empowered to employ all necessary equipment for carrying out the recommendations. The writer returned to Catlettsburg on April 10.

PADUCAH.

The writer arrived at Paducah on the evening of April 12, and by previous arrangement with the secretary of the State board of health was met there by Dr. W. W. Richmond, a member of the board and serving as one of the field inspectors.

A conference was held that evening with the local health authorities, and on the following morning the writer and Dr. Richmond, accompanied by the president of the city board of health (who is also an acting assistant surgeon of the Public Health Service and in charge of service operations for the port of Paducah), the city health officer, and the county health officer, made a sanitary survey of the city and its environs.

Paducah has a population of about 25,000. When the flood was at its crest about one-third of the houses in the city were in water. By April 13 the water had receded from the streets in about one-half of the area which had been covered by the high water. The public water supply, obtained from the Ohio River and treated by coagulation, storage, and mechanical filtration, was quite generally distributed over the city. There were few, if any, wells or cisterns in the flooded sections. The equipment for the purification of the public water supply appeared to be adequate and the management of the waterworks appeared to be efficient, but as an extraordinary precaution the writer advised the treatment of the water with hypochlorite of lime. The water company immediately took steps to carry out this suggestion.

At the time of the high water there was some interference with the discharge from the city sewers and sewage backed up into a considerable proportion of the basements and cellars, but the interference with the sewers was relieved as the flood water began to recede from the city. A considerable proportion of the flooded area was non-sewered and contained numerous insanitary privies.

There are in the whole city about 3,000 privies, almost all of which were found to be insanitary privies of the surface, open-back type. In many sections of the city there were found on either side of long alleys, lines of these insanitary privies with their open backs abutting on the alleys and with their filthy contents thoroughly exposed to flies and overflowing into the alleys to be washed about by rains and disseminated over the town by wagon wheels and the feet of persons and animals. In view of the situation in respect to insanitary privies it is not surprising that the typhoid rate in the community has been high. The typhoid death rate for Paducah in 1912, a comparatively low-rate year for that general section of the country, was about 50 per 100,000 population.

From the very beginning of the flood period the local health authorities with highly commendable vigor and intelligence had had enforced sanitary measures. About 1,150 flood sufferers were taken care of in an encampment well located in a field near the edge of the city. Frame buildings, hastily but well constructed, were used for housing the persons in the encampment. The camp was supplied with city water and sewerage by means of pipes laid on the surface of the ground and extended out from connections with the city systems. The encampment was kept well policed and apparently in good general sanitary condition.

In removing persons from flooded homes to the encampment some cases of smallpox—previously not known about by the authorities—were discovered. Prompt measures to prevent the spread of the infection were carried out. Cases of the disease and their immediate associates were isolated. All persons in the camp who could not show evidence of recent successful vaccination were vaccinated. A general vaccination of school children and of employees in the city was rapidly carried out and all persons not certain of being immunized against smallpox were advised to get vaccinated. Thousands of persons were vaccinated and all presumably infected houses were fumigated. The outbreak comprising some 25 or 30 cases was quickly controlled.

In the flooded sections the usual sprinkling of lime in yards and alleys was done, basements, cellars, and flooded portions of houses were cleaned and disinfected with chloride of lime solution, and the homes before reoccupance had to be placed in good sanitary condition, especially in respect to proper arrangements for excreta disposal, and so certified by one of the inspectors from the health office. A liberal supply of antityphoid vaccine had been obtained and its extensive administration advised, but with results only a little better than were obtained from similar efforts to get this agent administered in Maysville (referred to above).

The local authorities had left little to be suggested in the way of additional sanitary measures feasible for the flooded sections of Paducah.

WYCKLIFF.

The writer, accompanied by Dr. Richmond, arrived at Wyckliff on the morning of April 14. After conference with the town health officer, the county health officer, and the mayor a sanitary inspection of the town was made. The greater part of Wyckliff is on well elevated ground overlooking the Mississippi River, and only about 10 per cent of the town's area was flooded. The flood along this part of the river's course began about March 28, reached its crest on April 9, and the water was just beginning to recede on April 14.

The population of Wyckliff in usual times is about 1,000, but in the latter part of March as the waters of the Mississippi began to rise a large number of refugees from the flooded sections on either side of the river came to Wyckliff, and the population of the town and its immediate environs within the course of a few days, ending March 30, was about quadrupled. Of the 3,000 refugees in the town about 2,600 were domiciled in private homes or public buildings, including the county courthouse, and about 400 in tents. On April 14 there were still about 600 refugees in the town, of whom about 100 were in the tented encampment. The presence of such a large number of persons in the town, though fortunately for only a short period, had resulted in a marked accentuation of the usual insanitary conditions.

A few private wells and cisterns are in use, but nearly all of the water used in the town is from the public supply. The public supply is obtained from a bored well, 137 feet in depth, located on the lower edge of the town toward the river. The 6-inch iron pipe of the well is said to pass through a deep stratum of potter's clay, which is regarded as being impervious to water. The water from this well is said to be at all times abundant for the needs of the town. The water is clear, free from objectionable taste or odor. It is probably a safe supply, but on account of the extensive pollution of the surface soil uphill from and in the neighborhood of the well the sending of samples of the water periodically to the State laboratory for bacteriological examination was advised.

The town has no public sewerage system. A few of the houses have water-closets connected with small private sewers, which discharge over the sides of the hills or into small surface streams in the town. Most all of the homes are provided with insanitary privies—generally of the open-back surface type—and most of these privies were severely overtaxed by the extra use of them by refugees during the flood period. The writer, in a somewhat extensive experience in the making of sanitary surveys in different parts of the United States, has visited no community in which the conditions in respect to insanitary privies were worse than they were found in Wyckliffe, nor in which there appeared to be on the part of the municipal authorities less apprehension about the potential dangers inevitably associated with such conditions. No satisfactory records were obtainable, but it is the safest kind of a guess that Wyckliffe's rate from typhoid fever and other diseases caused by excreta-borne infections is high summer after summer.

At the time of the inspection one case strongly suggestive of typhoid fever existed among the refugees, and no adequate precautionary measures were being carried out at the bedside of this case to prevent the spread of probable infection. The encampment was

found to be poorly policed. The privies in the encampment, consisting of one pit privy and one surface privy, were inadequate and filthy. Privies, also grossly insanitary, at homes in the neighborhood were being used to a considerable extent by persons from the camp.

Upon completing the sanitary inspection the writer made to the mayor and to a number of the local business men, assembled on the invitation of the county judge, a report embodying recommendations especially for (1) the exercise of proper precautions about the persons of suspected cases of infectious disease; (2) the sanitation of existing privies; (3) the reconstruction on sanitary principles and the proper maintenance of privies throughout the town; and (4) the installation, ultimately and as soon as practicable, of a complete water-carriage sewerage system.

COLUMBUS.

Columbus was visited by Dr. Richmond and the writer on April 15. This town, with a population of about 1,000, was severely flooded. The water in some parts of the town was over 15 feet in depth, and of all the houses within the incorporated limits of the town only six remained out of water.

The water came up gradually, however, and Columbus, unlike the torrent-swept towns on the Ohio River, suffered very little damage from the overturning and washing away of houses. On April 15 the water was still high, having receded to the extent of only 1 foot from the height reached when the flood was at its crest. The majority of the townspeople remained in their homes throughout the period of the flood, living on the upper floors of their houses. Street traffic was done entirely by means of boats. About 400 persons temporarily abandoned their homes and went to stay with neighbors in the surrounding country or went into the tented encampment established on the outer margin of the town on the slope of a hill. The greatest number of persons domiciled in the encampment at any one time was about 250. Columbus has no public water supply nor sewerage system. Water is obtained from wells—mostly driven wells—and cisterns. Many of the wells and cisterns were rendered inaccessible by the high water, and water for drinking and culinary purposes was obtained from wells and cisterns at homes in the surrounding country and distributed to the townspeople.

Most of the privies in the towns were, on account of the high water, inaccessible for inspection, but were said to be generally of the insanitary surface or unscreened box type.

The camp was found to be well policed and, except for some faulty privies, in good general condition. The county health officer, who was a member of the relief committee and who was looking after

sanitary conditions, had kept a close supervision over the sick and reported that during the flood period no cases or suspected cases of typhoid fever or of other infectious diseases had developed.

Upon completion of the inspection a conference was held with the members of the relief committee, and such recommendations as appeared pertinent to the situation were made. Among the measures especially advised for immediate application were (1) sanitation and improvement of construction of the privies being used in the encampment and at homes—out of water—in the neighborhood thereof, and (2) the preparation and distribution of bottles of hypochlorite solution for the treatment of drinking water. The necessary steps to carry out these suggestions were taken at once by the committee. The members of the relief committee furthermore expressed their intention to carry out, so far as might be practicable, as the water receded from the town, the other measures advised consisting of those which are generally applicable for the sanitation of flood-stricken towns. As funds were not locally available for the purchase of disinfectants needed, the Public Health Service furnished, on the recommendation of the writer, a carload of quicklime for use in the sanitation of Columbus. After conference with the relief committee a public meeting attended by about 200 of the citizens was addressed on the subject of the local sanitary situation. At this meeting the adoption of permanently effective sanitary measures, such as the securing of a good public water supply and the installation and maintenance of sanitary privies or of a water-carriage sewerage system, was urged.

The writer, throughout the course of this work in flood-stricken towns and cities, received and was materially assisted by the cordial and hearty cooperation of the State and local health officials with whom he was associated. So far as he has been able to ascertain there have been, since the flood, no outbreaks of infectious disease in, nor any unusual spread of infection in the course of interstate traffic from, any of the flood-stricken towns or cities in Kentucky.

Conclusions.

1. Floods such as occurred in the Ohio and Mississippi Valleys in the spring of 1913 occasion sanitary situations of considerable gravity.

2. The insanitary conditions obtaining in most flood-stricken towns and cities represent in large part merely an accentuation of conditions which were faulty and dangerous before the period of flooding.

3. Insanitary conditions occasioned by floods in towns or cities which immediately prior to being flooded have had good and complete public water supplies and water-carriage sewerage systems are, as a rule, readily correctible.

4. The installation and maintenance of sanitary devices for the proper disposal of human excreta is, as a rule, the most important single measure needed for safeguarding the health of flood-stricken communities.

5. The treatment of water supplies with hypochlorite of lime is a thoroughly feasible measure, which has a wide range of applicability in flood-stricken towns and cities.

6. Antityphoid inoculation, though capable of affording a very considerable degree of protection against typhoid infection, does not appear in its present stage of exploitation to be a measure practicable for extensive application in flood-stricken communities.

7. The work of sanitation precipitated by flood conditions may be, and should be, directed to effect permanent sanitary improvements.

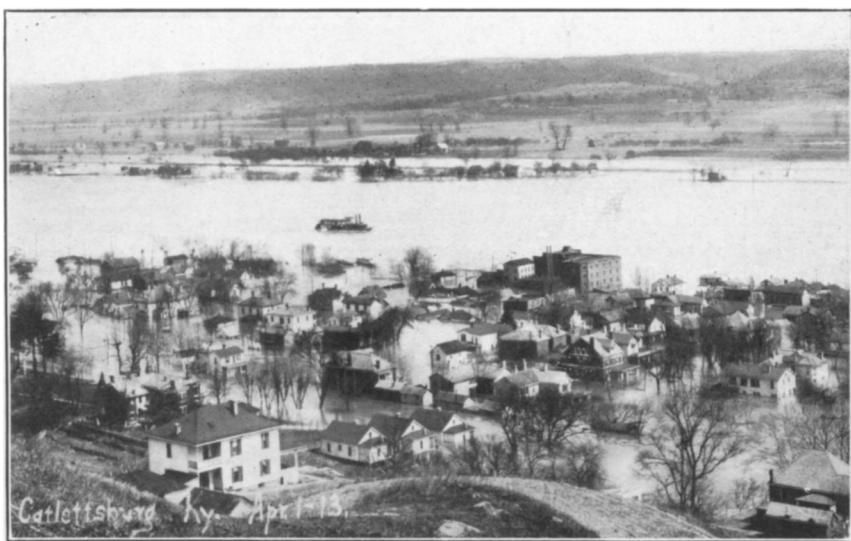


Fig. 1.—BIRD'S EYE VIEW OF CENTRAL SECTION OF CATLETTSBURG, KY., WHEN FLOOD WAS AT ITS HEIGHT.



Fig. 2.—VIEW OF EAST SECOND STREET, MAYSVILLE, KY., WHEN THE FLOOD WAS AT ITS CREST.



Fig. 3.—CONDITIONS IN FLOOD-SWEPT SECTION OF MAYSVILLE, KY.



Fig. 4.—DÉBRIS LEFT IN STREETS BY THE FLOOD. SCENE ON FRONT STREET IN CATLETTSBURG, KY.